VARIATION IN YUCCA WHIPPLEI

Lee Haines

Yucca Whipplei, a species which is widespread and abundant in southern California, is a member of the family Agavaceae Hutchinson. It ranges from Laguna Seca Chapala in northern Lower California (29° 30′ N. Lat.) to Chew's Ridge in Monterey County, California (36° 30′ N. Lat.). The species varies greatly in appearance and it is apparent from casual observation that the variants are geographical in some degree. However, the nature of the genus *Yucca* is such that this variation can be studied adequately only in the field. Few herbarium specimens exist and these afford at best only the most general information as to the nature of the plant. The investigation has accordingly been carried on solely in the field. This was particularly necessary since it was found from preliminary observations that the size and conformation of the flower and fruit have essentially the same degree of variability throughout the species and that any conclusions must perforce be drawn from a comparative quantitative study of the vegetative characteristics and habit of the inflorescence.

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Distribution

Before any observations or measurements could be made, it was necessary to discover where, in the vast area within its limits, *Yucca Whipplei* grows. The distribution area was divided into geographic sections and reconnoitered in an automobile by traversing as many of the highways, secondary roads, fire roads, and truck-trails as possible. By traveling approximately four thousand miles, the entire area was surveyed and the approximate distribution limits of the species were established (fig. 1). During this reconnaissance, stops were made at favorable localities and observations and measurements were recorded. Such a locality was treated as a field station, designated by a number, and located on a topographic map.

In Lower California the distribution has not been determined in detail. The species was observed at the Laguna Seca Chapala, in the mountains east of Rosario, in the chaparral-covered coastal hills near Sacaton between Ensenada and San Vicente, and north of Ensenada. In southern California it is found in the mountains from Campo northward through the Laguna and Balkan moun-

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tains to the San Jacinto and Santa Ana mountains. It is continuous in a narrow strip from the San Jacinto Mountains to the San Bernardino, San Gabriel, Santa Susana, and Santa Monica mountains to Mount Piños and the Tehachapi mountains. Here the area divides, one branch extending northward in the Piute and

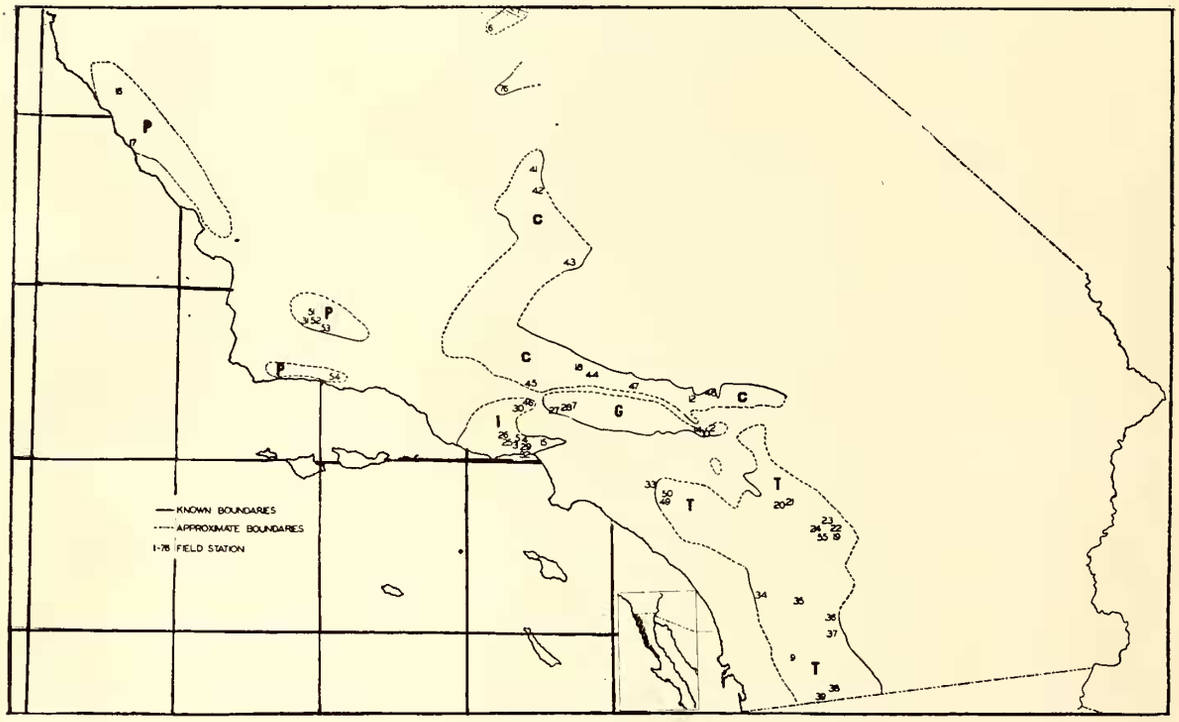

FIG. 1. Distribution of *Yucca Whipplei* in California and Baja California. G, subsp. *Parishii;* P, subsp. *percursa;* I, subsp. *intermedia;* C, subsp. *caespitosa;* T, subsp. *typica.*

Greenhorn mountains and to the western margin of Sequoia National Park, the other passing northward through the Santa Ynez, San Rafael, and Santa Lucia mountains to Chew's Ridge, north of Tassajara Hot Springs in Monterey County. The species is maritime from the Santa Monica Mountains northward. Southward from Walker Pass to the eastern end of the San Bernardino Mountains, it occurs on the margin of the Mojave Desert.

The distribution of *Yucca Whipplei* is not continuous throughout its range. There are major gaps between the Santa Ana and the Santa Monica mountains, between the Santa Monica and the Santa Ynez mountains, between the San Rafael and the Santa Lucia mountains, and between the Walker Pass region and the region along the western border of Sequoia National Park. Within these lesser areas the species is either diffuse and general or may be localized. Throughout its entire range *Yucca Whipplei* usually occurs in very porous, shallow soil or on rocky outcrops at elevations from sea level up to 6000 or 8000 feet. When growing on ridges or walls it is found on slopes which have an exposure toward the south.

Growth-Forms

It soon became apparent from field observation that at least four types of growth-forms exist in this species and that these forms are correlated with the geographic distribution. These growth-forms may be briefly characterized as follows: (1) a soli-

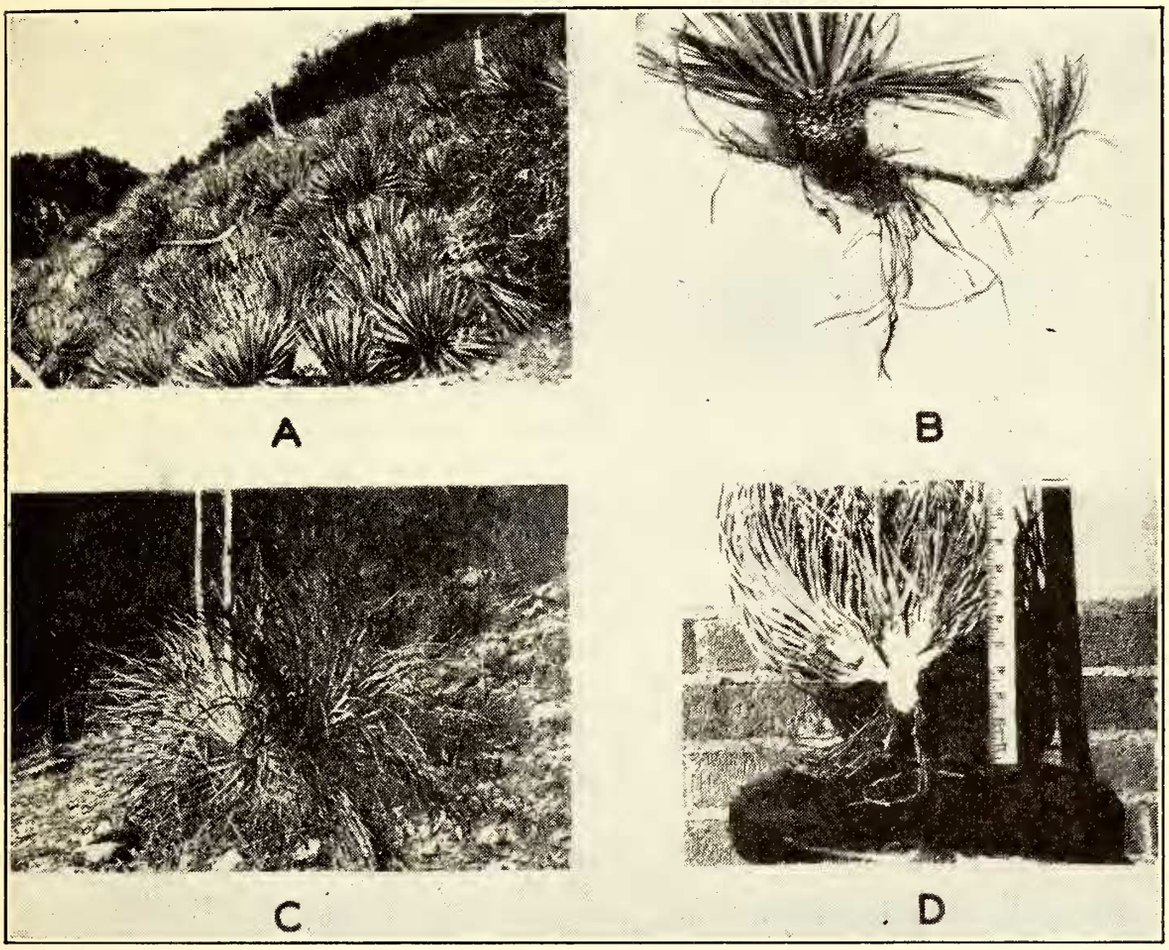

Fig. 2. *Yucca Whipplei.* A, a colony, perhaps a single clone, of subsp. *percursa,* San Rafael Mountains. B, a single plant from such a colony showing a short newly developed rhizome. C, an individual of subsp. *intermedia,* Santa Monica Mountains. The branch on the left has died back after flowering, that on the right has developed from an axillary bud on the dead branch. D, a small specimen of subsp. *caespitosa* from Walker Pass showing the method of branching from the original stem. Such proliferation may continue before flowering takes place until a clump of a hundred or more rosettes is formed.

tary form, with a simple unbranched, bulbous stem which dies as soon as the plant has flowered; (2) a caespitose form in which the stem branches on the surface of the ground to form a clump of plants composed of from four to one hundred or more distinct rosettes, several of which may send up flower stalks in the same season; in this case, numerous rosettes are formed before any flowering takes place (fig. 2, D); (3) a caespitose form, occasionally solitary, in which the stem branches by means of axillary buds which form short lateral branches; in this case new rosettes are usually formed only after flowering and the dying back of a

branch; one or several rosettes may thus be formed, but only one flower stalk is usually produced in any given season (fig. 2, C); and (4) a rhizomatous form, the stem branching by means of underground rhizomes to form dense colonies of asexually produced individuals (fig. 2, A, B).

The solitary form (1) occurs in San Diego, Riverside, Orange, San Bernardino, and Los Angeles counties in two regions which are geographically isolated. They are indicated in Figure 1 by the letters "T" and "G." Actually each of these regions is occupied by a distinct form which may be segregated on the basis of size. The caespitose form (2) with many rosettes, of which several flower in each season, occurs on the western margin of the Mojave Desert from the San Bernardino Mountains east and north to Tehachapi Pass and from there into the Piute and Greenhorn mountains. The distribution of this form is indicated in Figure 1 by the letter "C." The caespitose form with few rosettes (3), only one flowering in each season, occurs throughout the Santa Monica and Santa Susana mountains in the area marked "I." The rhizomatous form (4) occurs in the San Rafael, Santa Ynez and Santa Lucia mountains; its distribution is indicated in Figure 1 by "P". The only point at which any of these races are known to merge and exhibit intermediates lies in the Cajon Pass area where hybridization is apparently frequent between the solitary montane form and the caespitose desert form. There are also two isolated regions in the southern Sierra in which *Yucca Whipplei* grows: along the western border of Sequoia National Park and on the Middle Fork of the Tule River in the Sierra Nevada foothills. The data regarding these two localities are incomplete and the plants growing there (as well as those of Lower California) have been eliminated from present consideration. It seems probable, that although the proportions are similar to those of the solitary form, they are distinct and form another subspecies because of the nature of branching.

Variation of Inflorescence and Leaves

After discovering that the members of this species possessed four forms of growth habit, the question arose as to whether the morphology of the inflorescence and proportions of the whole plant might not be correlated with the growth habit and geographic distribution. The answer to this question is based upon a statistical treatment of the measurements taken at each field station.

The following characters were recorded for each of 1114 plants studied in the field (certain other characters were also recorded, but these were found not significant for the present purposes): (1) the height of the flower stalk, (2) the length of the panicle, (3) diameter of the panicle at its widest point, (4) the diameter of the flower stalk as measured one meter above the surface of the ground, and (5) the length of the leaves. The measurement of characters (1) and (2) were made to the nearest six inches,

while character (3) was measured to the nearest inch. At a point one meter above the ground level, the diameter of the flower stalk (4) was measured with outside calipers to the nearest eighth of an inch. The length of the leaf (5) was measured to the nearest inch (fig. 3, C).

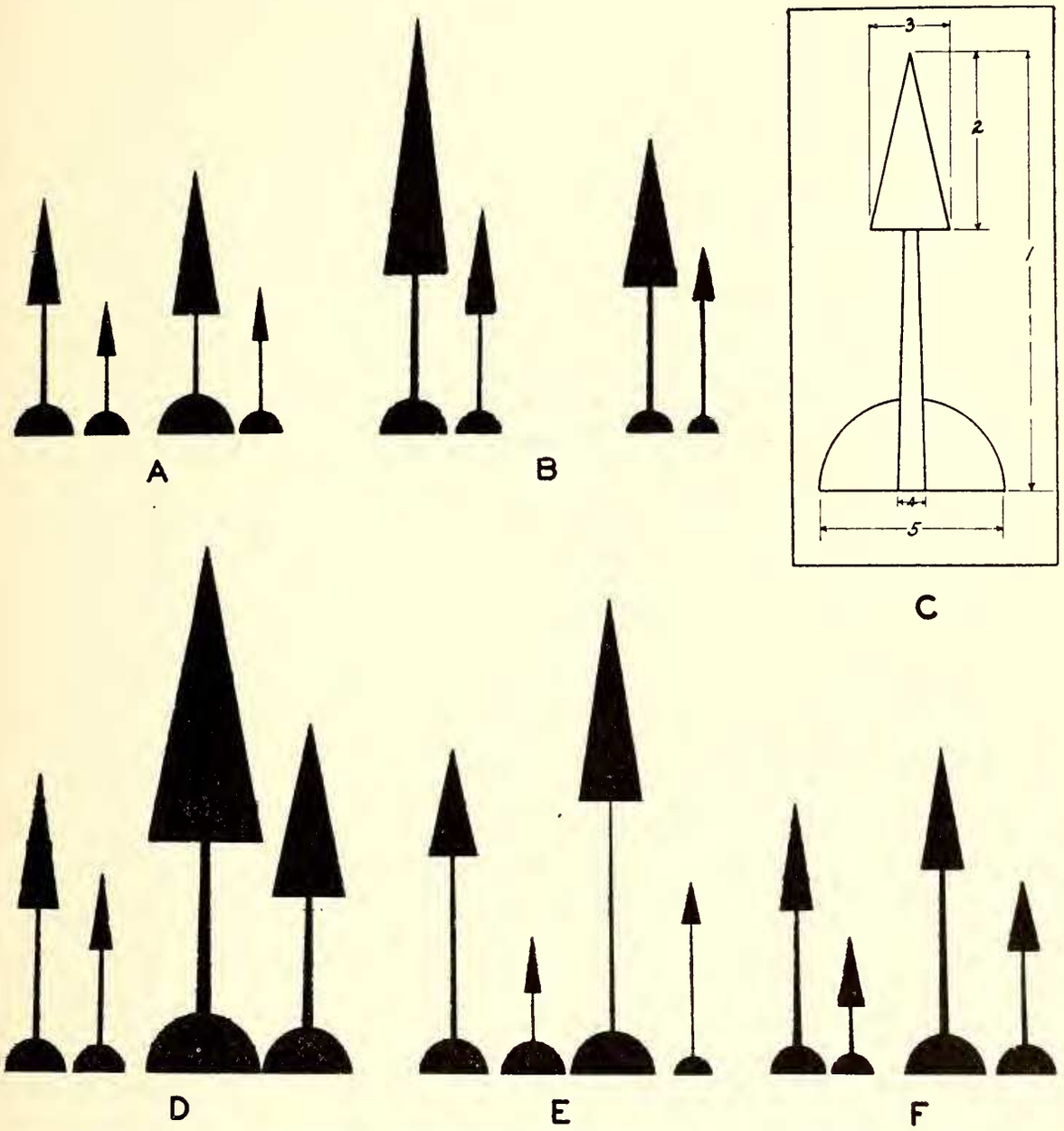

FIG. 3. Ideographs which summarize the measurements made upon twenty plants of *Yucca Whipplei* from ten stations. Each pair of stations is from the same geographic region and was so chosen as to illustrate the extremes of variation measured in that region. A, subsp. *caespitosa;* B, subsp. *percursa;* D, subsp. *Parishii;* E, subsp. *intermedia;* F, subsp. *typica.* The dimensions measured are shown in C. The stations follow: A, left, station 43, eight miles northwest of Mojave, Kern County; A, right, station 47, 1 mile above Valyermo; B, left, station 16, Santa Lucia Memorial Camp, Monterey County; B, right, station 51, 5 miles north of Los Olivos, Santa Barbara County; D, left, Arrowhead Springs, San Bernardino County; D, right, station 28, Tujunga Wash, Los Angeles County; E, left, station 26, Malibu Lake, Los Angeles County; E, right, station 15, West Los Angeles; F, left, station 35, 2 miles south of Lake Henshaw, San Diego County; F, right, station 21, 10 miles east of Hemet, Riverside County.

TABLE 1

Arithmetic Means for Measurements of Morphological Characters of *Yucca Whipplei* from Each Field Station, Showing the Total Range of Variation in the Species

Field Station Number	Number of Plants	Height of Flower Stalk in Feet	Length of Panicle in Feet	Diameter of Panicle in Inches	Diameter of Flower Stalk in Inches	Length of Leaves in Inches
4	16	8.47	3.53	13.80	1.23	21.70
6	14	13.90	6.46	21.70	3.21	34.00
7	12	12.40	5.58	34.20	3.16	29.50
8	12	13.00	6.33	25.10	3.02	28.50
9	17	7.35	2.70	11.10	1.83	25.00
10	19	9.65	4.02	11.70	2.59	25.90
12	12	9.07	4.17	13.30	1.96	22.40
13	12	8.71	3.92	14.90	1.87	21.40
14	12	12.67	6.20	12.67	3.02	31.00
15	48	10.45	3.65	17.35	1.42	28.74
16	24	11.45	5.95	21.60	2.70	24.33
17	24	10.30	4.94	16.60	1.79	25.70
18	36	7.65	3.54	12.10	1.88	21.00
19	16	9.80	4.15	19.00	3.42	25.50
20	12	8.70	3.30	14.50	2.33	32.00
21	12	10.00	4.30	14.75	2.26	28.70
22	25	9.20	3.83	14.80	3.23	21.40
23	12	9.65	4.00	16.20	3.21	24.00
24	12	8.76	4.16	17.40	3.16	24.00
25	48	7.15	2.98	13.40	1.00	24.20
26	52	8.60	3.27	14.10	1.10	26.30
27	12	17.40	9.33	33.90	4.71	29.00
28	12	16.36	8.96	32.40	4.20	32.50
29	53	9.93	3.87	17.30	1.42	28.45
30	36	9.13	3.88	14.80	1.31	25.80
31	36	9.70	5.03	16.03	2.44	16.47
32	13	10.20	3.96	16.05	1.34	30.15
33	12	7.68	2.72	9.35	1.39	25.80
34	12	8.90	3.22	12.60	1.43	29.30
35	24	6.90	2.87	11.10	1.46	20.30
36	12	6.92	3.08	12.67	1.58	21.70
37	12	9.00	4.21	16.40	2.81	26.20
38	12	6.50	2.67	10.20	1.28	21.50
39	12	6.45	2.46	11.20	1.23	21.20
40	24	8.70	3.50	15.50	1.22	33.40
41	26	6.60	2.54	10.00	1.00	20.20
42	24	9.05	3.62	14.20	1.44	25.50
43	36	6.54	2.56	9.75	1.26	22.60
44	12	6.50	2.85	9.60	1.00	18.20
45	12	8.75	3.62	15.30	1.25	29.60
46	12	9.17	4.20	17.85	1.36	29.60
47	25	8.42	3.58	16.95	1.23	18.70
48	25	5.90	2.78	9.16	.86	18.52
49	36	7.90	3.30	10.80	1.57	23.60
50	13	8.48	3.38	12.10	1.56	22.20
51	25	9.18	4.42	15.90	2.09	17.30
52	25	8.88	4.44	16.16	1.89	16.44
53	50	7.91	3.61	13.50	1.62	16.04
54	17	9.60	4.26	15.50	1.88	22.60
76	48	15.10	7.86	23.90	3.64	43.00

In Table 1 are listed the field stations whose locations are indicated by number in Figure 1 together with the number of plants measured at each station and the average value of each of

TABLE 2

Arithmetic Mean, Standard Deviation and Standard Error of the Mean for the Characters Measured and Segregated by Geographic Regions and Growth-Forms

Yucca Whipplei Subspecies	Height of Flower Stalk	Length of Panicle	Diameter of Panicle	Diameter of Flower Stalk	Length of Leaves
caespitosa, C	7.58 ± .102	3.27 ± .587	12.06 ± .247	1.31 ± .028	23.13 ± .340
typica, T	8.32 ± .103	3.14 ± .060	13.30 ± .240	2.14 ± .050	23.93 ± .330
Parishii, G	13.16 ± .369	4.40 ± .253	23.46 ± .942	3.35 ± .109	28.98 ± .637
intermedia, I	9.27 ± .144	3.62 ± .662	15.42 ± .275	1.22 ± .162	26.68 ± .305
percursa, P	9.33 ± .170	4.62 ± .813	16.90 ± .292	1.99 ± .392	18.87 ± .349

these five characters. The data given in Table 1 show the mean measurements for each station but not the range; that is, the differences between two plants which might be found growing side by side. The ideographs shown in Figure 3 will give an approximate idea of this range, that is, the amount of variation at a given station. The proportions of the individuals, as determined by the measurements indicated, are reconstructed in the ideographs, a method suggested by Edgar Anderson (Ann. Mo. Bot. Gard. 15: 241–332. 1938). Each of the ideographs in Figure 3 represents an individual plant from one of the five geographic regions indicated in Figure 1. The left pair of ideographs in each figure represents the largest and smallest plants found at one station, the right pair of ideographs in each figure, the largest and smallest plants found at a second, but widely separated, station within the same geographic region. These have been selected in such a way as to illustrate the extremes of variation found in each of the five geographical regions.

The arithmetic mean, the standard deviation and standard error of the mean were computed for each of the five characters of all the plants measured in each geographical region. These data are given in Table 2. From the arithmetic means ideographs were constructed which represent the mean proportions of the inflorescence and leaves of the yuccas of each of the five geographic regions. These are shown in Figure 4, where "G" represents the solitary form growing in the San Bernardino and San Gabriel mountains; "P" represents the rhizomatous form growing in the San Rafael, Santa Ynez and Santa Lucia mountains; "I" represents the caespitose form growing in the Santa Monica and Santa Susana mountains; "T" represents the solitary form growing in San Diego, Riverside and Orange counties; and

"C" represents the caespitose form growing on the western margin of the Mojave Desert.

These ideographs indicate that there is a recognizable difference in the mean morphology of the inflorescence and proportions of the vegetative parts which is correlated with the four forms of growth habit of the stem. This fact is consonant with and gives a quantitative expression of facts which had already been recognized intuitively from more or less casual observation. The differences between the two solitary forms "G" and "T" are so marked that the author proposes to separate them purely on the basis of the size and proportion of the inflorescence, particularly since the two forms are geographically segregated.

In order to determine whether the differences presented in Table 2 and Figure 4, are statistically significant, the standard

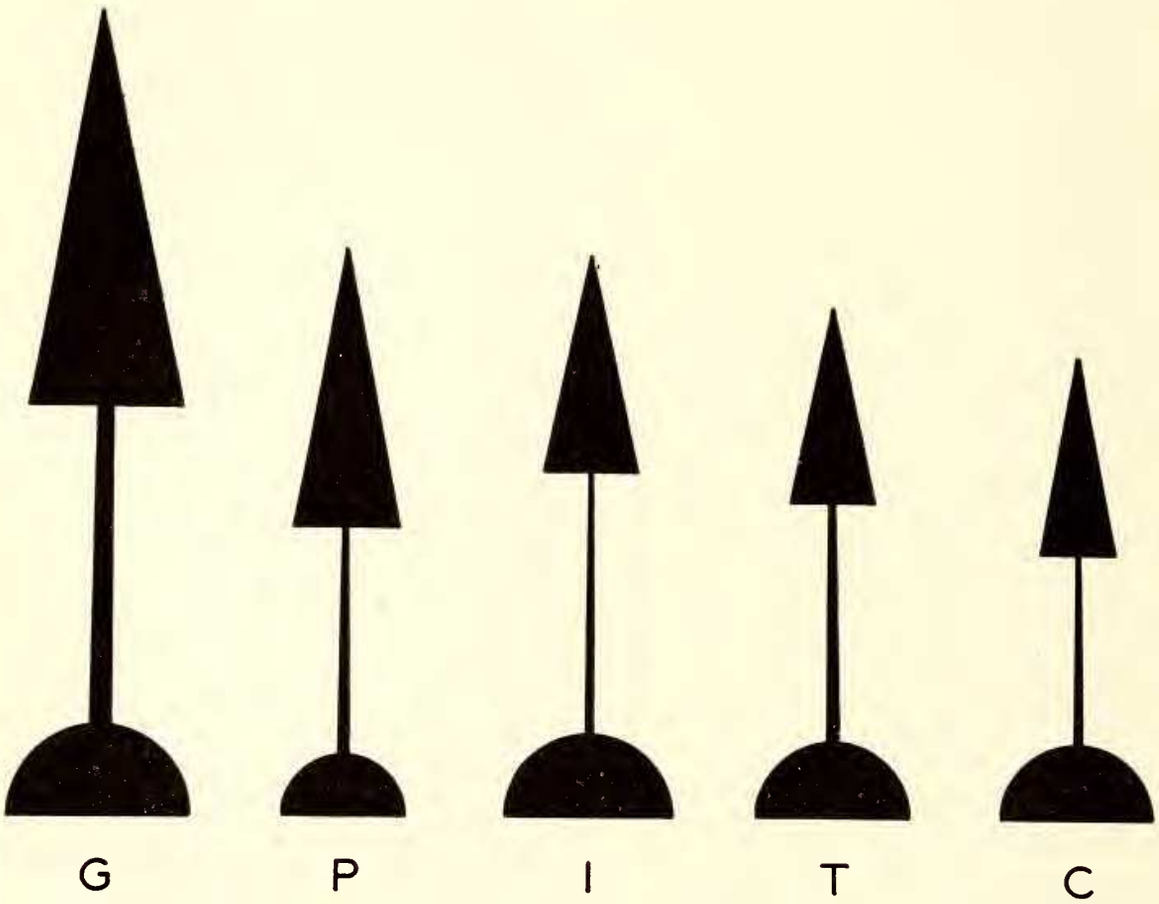

FIG. 4. Ideographs representing the mean proportions of five regional subspecies of *Yucca Whipplei*: G, subsp. *Parishii;* P, subsp. *percursa;* I, subsp. *intermedia;* T, subsp. *typica;* C, subsp. *caespitosa.*

error of difference was computed for the one hundred possible combinations of comparable characters represented in the ideographs. The resultant differences are recorded in Table 3, and expressed as critical ratios. When the critical ratio has a value greater than three, it is assumed that the differences between the means are statistically significant and that the characters measured may safely be considered as having arisen from sepa-

rate populations in which the true values for these characters are not alike.

TABLE 3

Critical Ratios Derived from the Standard Error of Difference between One Hundred Pairs of Means, as Shown

		typica	Parishii	intermedia	percursa	caespitosa
Parishii	h.F.S.		9.83	6.20	5.05	5.10
	l.Pan.		4.83	0.72*	1.81*	0.22*
	d.Pan.		10.45	5.80	9.55	3.58
	d.F.S.		10.10	5.45	0.38*	2.92
	l.Lvs.		7.05	6.13	10.40	1.69*
typica	h.F.S.			10.10	11.90	14.60
	l.Pan.			1.10*	0.25*	1.77*
	d.Pan.			8.20	6.66	11.70
	d.F.S.			10.90	3.34	182.00
	l.Lvs.			3.26	10.11	9.05
intermedia	h.F.S.				0.29*	11.05
	l.Pan.				0.74*	0.39*
	d.Pan.				3.70	9.10
	d.F.S.				1.82*	0.55*
	l.Lvs.				16.80	11.00
percursa	h.F.S.					8.83
	l.Pan.					0.77*
	d.Pan.					12.60
	d.F.S.					1.73*
	l.Lvs.					8.75

* Critical ratios which do not indicate a significant difference between the two means compared.

h.F.S.—height of flower stalk.
l.Pan.—length of panicle.
d.Pan.—diameter of panicle.
d.F.S.—diameter of flower stalk.
l.Lvs.—length of leaves.

While these ratios are statistically significant, their taxonomic significance must be interpreted largely upon the basis of experience. These critical ratios suggest that the order of significance of the morphological characters are: the diameter of the panicle, the height of the flower stalk, the length of the leaves, the diameter of the flower stalk, and the length of the panicle.

While some of the characters compared in Table 3 are not significantly different, the summation of habit which they express is. It is therefore clear that each geographic race or growth-form may be distinguished solely by mean size and proportions of its inflorescence and leaves.

Conclusion

It has been shown above that *Yucca Whipplei* is represented throughout its range by four growth-forms and that significant

differences of inflorescence and leaves are correlated with these growth-forms. Furthermore, it has been shown that one growth-form, the solitary type, is characteristic of two forms which differ significantly in habit of inflorescence and foliage and are geographically segregated. It appears, therefore, that *Yucca Whipplei* is represented by not less than five geographic races. That others may exist seems possible, in so far as the author is able to judge from the limited number of observations which were made on the forms of Lower California and the Sierra Nevada. The question arises, then, as to a suitable taxonomic treatment of these forms. It seems preferable, until there is evidence that more than geographic barriers segregate them, to treat the geographic races, discussed above, as subspecies.

Taxonomy

Yucca Whipplei Torrey, Botany of the Mexican Boundary 22, 1859, type collected by Schott at San Pasqual, San Diego County, California (Torrey Herb., N. Y. Bot. Gard.). *Y. aloifolia* Torrey in Report Whipple Exped., Botany 147, 1856 (not L.). Type collected in Cajon Pass by the Whipple Expedition; since two subspecies with intermediate hybrids occur here it is uncertain to which form this reference applies. *Hesperoyucca Whipplei* Baker in Kew Bull. p. 8, 1892.

Nearly acaulescent, stem simple or branched; leaves in a basal rosette, 0.125–0.75 inches wide, 1–4 feet long, linear-lanceolate, tipped with a slender spine, fibrous, evergreen, flat to more or less triquetrous, finely striate, their margins serrulate; inflorescence 5–20 feet high; panicle oblong, 1.5–11.5 feet long, 0.5–3 feet in diameter; peduncle 0.5–6 inches thick; perianth segments distinct, nearly equal; filaments clavate, attached to the base of the perianth; capsule short-cylindric, 1.5–2 inches long.

Key to the Subspecies

Stem branched, only the flowering branch dying back after flowering, both dead and living rosettes usually present.
- Stem branching by means of rhizomes, forming dense colonies of asexually produced individuals ..... a. subsp. *percursa*
- Stem branching on surface of ground, forming a clump of from 4 to 100 or more rosettes; several inflorescences may arise from a clump of rosettes in a single season ..... b. subsp. *caespitosa*
- Stem branching by axillary buds to form short lateral branches; only one inflorescence arises from a group of rosettes in a single season ..... c. subsp. *intermedia*

Stem unbranched, solitary, the whole plant dying after flowering.
- Flower stalk 5–13 feet in height, 1–4.5 inches in diameter; panicle 1.5–7 feet in length, .5–2 feet in diameter; San Diego, Riverside and Orange counties and northern Lower California ..... d. subsp. *typica*
- Flower stalk 7–20 feet in height, 1.5–6 inches in diameter; panicle 3–11.5 feet in length, 1–3 feet in diameter; San Gabriel and San Bernardino mountains ... e. subsp. *Parishii*

a. Yucca Whipplei subsp. **percursa** subsp. nov. Type collected on Cachuma Mountain in the San Rafael Mountains of Santa Barbara County, California, *A. L. Haines* (deposited in the Herbarium, University of California, Los Angeles).

Caudex longitudine 30–60 cm., in basi rhizomata elongata ferens et ut videtur clonum diffusum faciens; rhizomatibus maturis diametro circiter 2–3 cm., longitudine ad 2 m. et ultra; scapo altitudine ad 5 m. maximam partem circiter 3 m.; scapi in altitudine 1 m. supra humum diametro ad 8 cm., maximam partem 5 cm.; paniculis longitudine ad 3 cm., maximam partem circiter 1.5 m. et diametro in latissima parte ad 70 cm., maximam partem circiter 40 cm.; foliorum longitudine ad 1 m., maximam partem circiter 45 cm.

Stem 1 to 2 feet long, producing rhizomes at its lower end; mature rhizomes 1 inch in diameter, 2–6 or more feet in length producing new individuals from the terminal buds to form a dense stand which may be considered as a clone; height of flower stalk 5–16 feet, average 9.3 feet; diameter of flower stalk at one meter above ground .75–3.5 inches, average 1.9 inches; length of panicle, 2–9.5 feet, average 4.6 feet; diameter of panicle at widest point, 6–28 inches, average, 17 inches; length of leaves, 10–35 inches, average 19 inches.

This subspecies is a component of both the coastal sage and chaparral formations, occurring mostly between 200 and 2000 feet; it is found in the San Rafael, Santa Ynez and Santa Lucia mountains of Santa Barbara and Monterey counties.

b. Yucca Whipplei subsp. **caespitosa** comb. nov. *Y. Whipplei* var. *caespitosa* Jones, Contrib. West. Bot. 15: 59. 1929, apparently based upon plants observed on the desert side of Cajon Pass.

Stem branching above the ground to form a crowded, caespitose clump of four to a hundred or more rosettes, several branches in a single clump often flowering at one time; height of flower stalk 4–13 feet, average 7.5 feet; diameter of flower stalk one meter above the ground, .5–2.75 inches, average 1.3 inches; length of panicle, 1.5–6 feet, average 3.25 feet; diameter of panicle at widest point 4–24 inches, average 12 inches; length of leaves 12–40 inches, average 23 inches.

This subspecies is an associate of the desert woodland, occurring particularly with *Juniperus californica,* usually between 2000 and 4000 feet. It may extend down into the upper limits of the desert shrub formation. It ranges north and west from Arrastre Creek in San Bernardino County along the western border of the Mojave Desert to the region of Walker Pass.

c. Yucca Whipplei subsp. **intermedia** subsp. nov. Type collected at Malibu Lake, Santa Monica Mountains, *A. L. Haines* (deposited in the Herbarium, University of California, Los Angeles).

Caudex a gemmis axillaribus pauciramosus in maturitate solum; scapo florifero saepius solitario altitudine ad 5 m. et ultra, maximam partem circiter 3 m. et diametro in altitudine 1 m. supra humum ad 5 cm., maximam partem circiter 3 cm.; paniculae longitudine ad 2.5 m., maximam partem circiter 1 m. et diametro in latissima parte ad 60 cm., maximam partem circiter 38 cm.; foliorum longitudine ad 1 m. et ultra, maximam partem circiter 60 cm.

Stem branching only by axillary buds after it is well matured; base of stem and roots persistent after flowering to form the subterranean portion of the new plants; only one flower stalk produced in a cluster of rosettes at one time; height of flower stalk 5–15.5 feet, average 9.25 feet; diameter of flower stalk, one meter above the surface of the ground, .5–2 inches, average 1.2 inches; length of panicle .5–7.5 feet, average 3.5 feet; diameter of panicle 6–28 inches, average 15 inches; length of leaves 13–40 inches, average 26 inches.

The type of branching of this subspecies seems to be intermediate between that of subsp. *typica* and subsp. *caespitosa*. It is found throughout the Santa Monica and Santa Susana mountains of Los Angeles and Ventura counties and occurs from sea level up to 2000 feet. It is an associate of the coastal sage and chaparral formations, particularly the chamisal of the latter.

d. Yucca Whipplei subsp. **typica** nom. nov. *Y. Whipplei* Torr. Bot. Mex. Bound. 22. 1859.

Stem simple, solitary, bulbous, dying when fruit has been formed; height of flower stalk 5–13 feet, average 8 feet; diameter of flower stalk, at height of one meter above the ground, 1–4.5 inches, average 2 inches; length of panicle 1.5–7 feet, average 3 feet; diameter of panicle at widest point 6–27 inches, average 13 inches; length of leaves 13–45 inches, average 24 inches.

This subspecies has a stout inflorescence with a thick, short flower stalk bearing a heavy panicle of compact flowers. It occurs from 1000 to 4000 feet and ranges through the Laguna, Balkan, San Jacinto, and Santa Ana mountains. It is associated chiefly with the chaparral formation, particularly the chamisal, but occasionally extends into the coastal sage and desert shrub formations.

e. Yucca Whipplei subsp. **Parishii** comb. nov. *Y. Whipplei* var. *Parishii* Jones, Contrib. West. Bot. 15: 59. 1929; type collected above Cajon Pass near San Bernardino (?). *Y. graminifolia* Wood, Proc. Acad. Philad. 20: 167. 1868, based upon plants observed in "the mountains twelve miles east of Los Angeles," perhaps near Monrovia.

Stem simple, solitary, dying when fruit has been formed; height of flower stalk 7–20.5 feet, average 13 feet; diameter of

flower stalk, at height of one meter above the ground, 1.5–6 inches, average 3.3 inches; length of panicle 3–11.5 feet, average 6.5 feet; diameter of panicle 1–3 feet, average 2 feet; length of leaves 17–46 inches, average 29 inches.

The largest individuals of *Yucca Whipplei* occur in this subspecies. It is distinguishable from the other solitary form of the species by the size of its inflorescence. In all dimensions measured the inflorescence of subsp. *Parishii* is nearly twice as large as the inflorescence of subsp. *typica*. The subspecies is found on the western slopes of the San Bernardino and San Gabriel mountains where it occurs from 1000 to 8000 feet elevation. At lower elevations it occurs with the chaparral and coastal sage formations, at higher elevations it ranges well into the montane forest.

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CERTAIN NORTH AND SOUTH AMERICAN DISTRIBUTIONS IN SCIRPUS

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Recent studies on collections of the cyperaceous genus *Scirpus* L. obtained in South America by the University of California Botanical Expedition to the Andes has revealed a surprisingly high degree of relationship between the species of this genus in the two hemispheres. Although one species is endemic to the California flora a large number of the species is wide ranging making it necessary to study both near and distant floras to discover their true affinities. The genus has many American species. Nothing approaching a general statement may as yet be given for their distribution. Some range widely, whereas others are very narrowly endemic or occupy discontinuous ranges.

The California flora contains sixteen species of *Scirpus* as follows: *S. microcarpus* Presl, *S. Congdoni* Britton, *S. criniger* Gray, *S. paludosus* A. Nels., *S. robustus* Pursh, *S. fluviatilis* (Torr.) Gray, *S. acutus* Muhl., *S. validus* L., *S. californicus* (C. A. Mey.) Steud., *S. Olneyi* Gray, *S. americanus* Pers., *S. nevadensis* Wats., *S. Clementis* Jones, *S. carinatus* Gray, *S. setaceus* L. and *S. cernuus* Vahl. The species known from Argentina were recently well organized by Barros (1). Without following Barros too closely the following entities may be recognized: *S. deserticola* Phil., *S. giganteus* Kunth, *S. paludosus, S. asper* Presl, *S. cubensis* Poepp. & Kunth, *S. californicus, S. validus, S. Olneyi, S. americanus, S. nevadensis, S. atacamensis* (Phil.) Boeckl., *S. rigidus* Boeckl., *S. macrolepis* Boeckl., *S. cernuus* and *S. inundatis* Poir. *Scirpus Clementis, S. criniger* and *S. Congdoni* are endemic in the North American flora while *S. atacamensis, S. rigidus, S. macrolepis, S. giganteus* and *S. deserticola* are